



TSU LT 220V USER MANUAL

Part Number 1203060L2

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About this Manual

This manual provides a complete description of the TSU LT 220V system and system software. The purpose of this manual is to provide the technician, system administrator, and manager with general and specific information related to the planning, installation, operation, and maintenance of the TSU LT 220V. This manual is arranged so that needed information can be quickly and easily found.



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Revision History

Document Revision	Date	Description of Changes
A	March 2004	Initial release of new part number.

Conventions



Notes provide additional useful information.



Cautions signify information that could prevent service interruption.



Warnings provide information that could prevent damage to the equipment or endangerment to human life.

Safety Instructions

When using your telephone equipment, please follow these basic safety precautions to reduce the risk of fire, electrical shock, or personal injury:

1. Do not use this product near water, such as a bathtub, wash bowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.
2. Avoid using a telephone (other than a cordless-type) during an electrical storm. There is a remote risk of shock from lightning.
3. Do not use the telephone to report a gas leak in the vicinity of the leak.
4. Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. They may explode. Check with local codes for special disposal instructions.
5. The socket-outlet shall be installed near the equipment and shall be easily accessible.

Save These Important Safety Instructions

Compliance Information

Product: **TSU LT 220V**
Model Numbers: **1203060L2**

Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio frequencies. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.



Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Warranty

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

Product Registration

Registering your product helps ensure complete customer satisfaction. Please take time to register your products online at www.adtran.com. Click *Service/Support* on the top of the page, and then click *Product Registration* under *Support*.

Customer Service, Product Support Information, and Training

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

A return material authorization (RMA) is required prior to returning equipment to ADTRAN. For service, RMA requests, training, or more information, use the contact information given below.

Repair and Return

If you determine that a repair is needed, please contact our Customer and Product Service (CAPS) department to have an RMA number issued. CAPS should also be contacted to obtain information regarding equipment currently in house or possible fees associated with repair.

CaPS Department (256) 963-8722

Identify the RMA number clearly on the package (below address), and return to the following address:

ADTRAN Customer and Product Service
901 Explorer Blvd. (East Tower)
Huntsville, Alabama 35806

RMA # _____

Pre-Sales Inquiries and Applications Support

Your reseller should serve as the first point of contact for support. If additional pre-sales support is needed, the ADTRAN Support web site provides a variety of support services such as a searchable knowledge base, latest product documentation, application briefs, case studies, and a link to submit a question to an Applications Engineer. All of this, and more, is available at:

<http://support.adtran.com>

When needed, further pre-sales assistance is available by calling our Applications Engineering Department.

Applications Engineering (800) 615-1176

Post-Sale Support

Your reseller should serve as the first point of contact for support. If additional support is needed, the ADTRAN Support web site provides a variety of support services such as a searchable knowledge base, updated firmware releases, latest product documentation, service request ticket generation and troubleshooting tools. All of this, and more, is available at:

<http://support.adtran.com>

When needed, further post-sales assistance is available by calling our Technical Support Center. Please have your unit serial number available when you call.

Technical Support (888) 4ADTRAN

Installation and Maintenance Support

The ADTRAN Custom Extended Services (ACES) program offers multiple types and levels of installation and maintenance services which allow you to choose the kind of assistance you need. This support is available at:

<http://www.adtran.com/aces>

For questions, call the ACES Help Desk.

ACES Help Desk (888) 874-ACES (2237)

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The Enterprise Network (EN) Technical Training Department offers training on our most popular products. These courses include overviews on product features and functions while covering applications of ADTRAN's product lines. ADTRAN provides a variety of training options, including customized training and courses taught at our facilities or at your site. For more information about training, please contact your Territory Manager or the Enterprise Training Coordinator.

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TSU LT 220V OVERVIEW

The TSU LT 220V belongs to the ADTRAN T1 single-port CSU/DSU family and offers complete flexibility in connecting various data sources to T1 or FT1 facilities (see Table 1-1).

Table 1-1. TSU Family of Single-Port CSU/DSUs

Product	Description
TSU ACE	T1 CSU/DSU with a single Nx56/64K serial port that offers front panel configuration only.
TSU LT	T1 CSU/DSU with a single Nx56/64K serial port that offers terminal, front panel, or T-Watch PRO configuration options.

The TSU LT 220V serves as the link between user data sources such as local area network (LAN) bridges and routers, computers, CAD systems, and teleconferencing equipment. The amount of bandwidth allocated to the port is custom programmable. The data terminal equipment (DTE) data can occupy contiguous or alternate channels in the T1 stream, and the channels may start at any position.

TSU LT 220V Physical Description

Figure 1-1 shows the TSU LT 220V front panel and Figure 1-2 shows the rear panel.

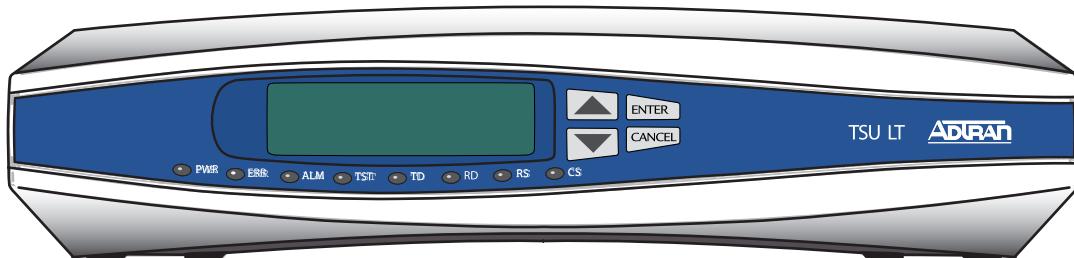


Figure 1-1. TSU LT 220V - Front Panel

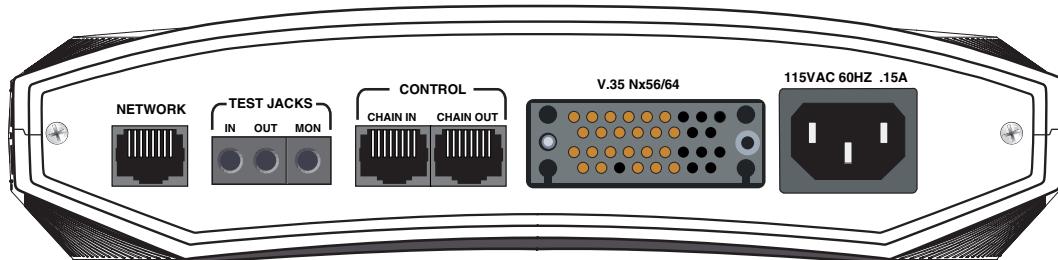


Figure 1-2. TSU LT 220V - Rear Panel

TSU LT 220V Features

- Easy configuration capabilities using simplistic menus displayed in a liquid crystal display (LCD) window operated by a front panel keypad.
- Timing is selectable from the network, from the Nx56/64 DTE port, or internally.
- Variety of test patterns: all ones, all zeros, 511, 1:8.
- Extensive self-testing and monitoring ensures proper operation.
- Flexible channel allocation (any starting channel and alternate or contiguous).

TSU LT 220V Interfaces

The TSU LT 220V is equipped with four interfaces:

- Network DS1 interface per AT&T 62411
- Nx56/64 serial V.35
- Control input (EIA-232)/Chain port input
- Chain port output

TSU LT 220V BRIDGE/ROUTER APPLICATION

A bridge or router can be interfaced to the network by using the V.35 DTE interface. The bandwidth used is programmable at Nx56 or Nx64 data rates for T1 or FT1 service. The bandwidth can be selected as contiguous or alternate. Figure 1-3 shows a simple bridge application.

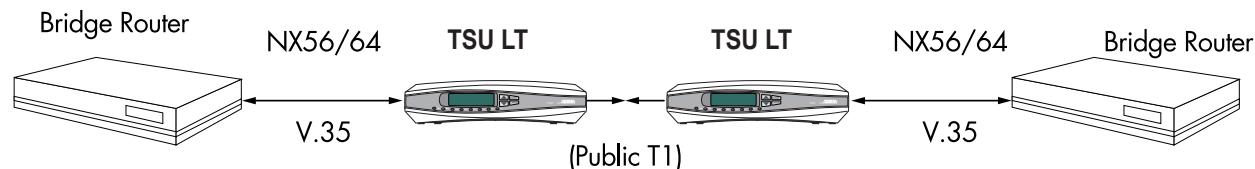


Figure 1-3. Simple Bridge Application on a T1 or an FT1 Circuit

TSU LT 220V SHIPMENT

Inspecting for Damages

Carefully inspect the TSU LT 220V for any shipping damage. If damage is suspected, file a claim immediately with the carrier and then contact ADTRAN Customer Service. If possible, keep the original shipping container for use in shipping the TSU LT 220V back for repair or for verification of damage during shipment.

Shipping Contents

The following items are included in the ADTRAN shipment:

- TSU LT 220V unit
- RJ-48 T1 cable
- Documentation CD
- Loopback plug



Customers must provide the DTE cable as well as a cable for the chain port, if the chain port is used.

INSTALLING THE TSU LT 220V

Grounding Instructions

Grounding instruction information from the *Underwriters' Laboratory UL 60950 3rd Edition* is provided in this section. An equipment grounding conductor that is not smaller in size than the ungrounded branch-circuit supply conductors is to be installed as part of the circuit that supplies the product or system. Bare, covered, or insulated grounding conductors are acceptable. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes. The equipment grounding conductor is to be connected to ground at the service equipment.

The attachment-plug receptacles in the vicinity of the product or system are all to be of a grounding type, and the equipment grounding conductors serving these receptacles are to be connected to earth ground at the service equipment. A supplementary equipment grounding conductor shall be installed between the product or system and ground that is in addition to the equipment grounding conductor in the power supply cord.

The supplementary equipment grounding conductor shall not be smaller in size than the ungrounded branch-circuit supply conductors. The supplementary equipment grounding conductor shall be connected to the product at the terminal provided, and shall be connected to ground in a manner that will retain the ground connection when the product is unplugged from the receptacle. The connection to ground of the supplementary equipment grounding conductor shall be in compliance with the rules for terminating bonding jumpers at Part K or Article 250 of the National Electrical Code, ANSI/NFPA 70. Termination of the supplementary equipment grounding conductor is permitted to be made to building steel, to a metal electrical raceway system, or to any grounded item that is permanently and reliably connected to the electrical service equipment ground.

Bare, covered, or insulated grounding conductors are acceptable. A covered or insulated grounding conductor shall have a continuous outer finish that is either green, or green with one or more yellow stripes.

The supplemental grounding conductor shall be connected to the equipment using a number 8 ring terminal. The terminal should be fastened to the grounding lug provided on the rear panel of the equipment. The ring terminal should be installed using the appropriate crimping tool (AMP P/N 59250 T-EAD Crimping Tool or equivalent).



Power to the TSU LT 220V must be from a grounded 220 VAC, 60 Hz power source.

TSU LT 220V Rear Panel

To install the TSU LT 220V, make the appropriate connections using Figure 2-1, Table 2-1, and the section *TSU LT 220V Interfaces* as guides.

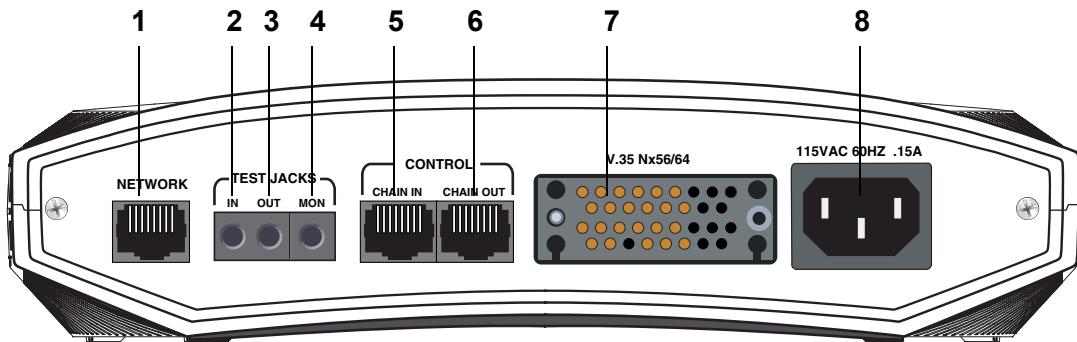


Figure 2-1. TSU LT 220V Rear Panel

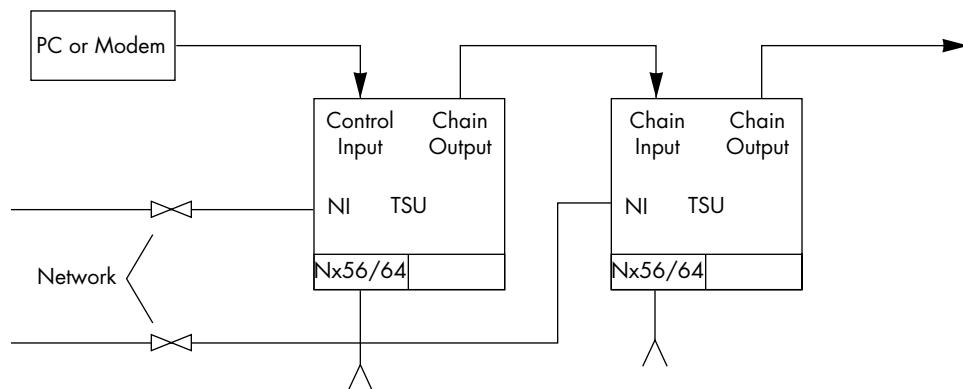
Table 2-1. Number Identification for TSU LT 220V Rear Panel

No.	Item	Function
1	Network	T1-FT1 network interface
2	In	Bantam test jack
3	Out	Bantam test jack
4	MON (Monitor)	Bantam test jack
5	Chain In	Interface of Chain In (Hyperterminal <Ctrl +PTT>, etc.)
6	Chain Out	Connects to Chain In of another TSU LT 220V
7	V.35 Nx56/64	DTE port
8	220 VAC 60 Hz 0.075A Power Receptacle	Accepts 3-prong power cord

TSU LT 220V Interfaces

Figure 2-2 on page 20 illustrates the four interfaces that come with the TSU LT 220V and how they might be connected. The interfaces include the following, and *Appendix C*, on page 55 shows the pinouts.

- Network DS1 interface per AT&T 62411
- Control input (EIA-232)/chain port input
- Chain port output
- Nx56/64 serial V.35

**Figure 2-2. TSU LT 220V Interfaces*****Network Interface (NI)***

The Network Interface (NI) port provides the connection to the T1/FT1. It complies with the applicable ANSI and AT&T standards.

Control Port Input (Chain In)

The control port input provides an EIA-232 input from a PC or a modem for control of the TSU LT 220V. You can also use it as a Chain input from any ADTRAN unit with a Chain port or as input for PC proxy agent control.

Chain Port Output (Chain Out)

The chain port output provides an EIA-232 chain output to other TSU LT 220Vs.

V.35 Nx56/64 Serial Interface

The Nx56/64 serial interface operates at the following data rates: Nx56K or Nx64K, where N=1 to 24 (DS0s).

POWER UP TESTING AND INITIALIZATION

Self-Test

When shipped from the factory, the TSU LT 220V is set to factory-default conditions. When you first power-up, the unit automatically executes self-tests followed by an initialization sequence which sets up the unit. The self-test checks the integrity of the internal operation of the electronic components by performing memory tests and by sending and verifying data test patterns through all internal interfaces. Although actual user data cannot be passed during these tests, the self-test can run with the network and DTE interfaces in place, without disturbing any external interface.

The self-test automatically executes upon power-up. It can also be commanded from a front panel menu or from the control port.

In addition to the specified self-tests, background tests are run on various parts of the internal electronics. These run during normal operation to confirm continued correct functioning. The background tests include the following:

- Monitoring the phase locked loop for lock.
- Standard background network performance monitoring.

The self-test works as follows:

If...	Then...
a power-up (or commanded) self-test occurs	the LCD displays ADTRAN TSU INITIALIZING and the LEDs illuminate sequentially.
the self-test completes with no failures detected	the LCD momentarily displays ALL TESTS PASSED.
a failure is detected	it is displayed in the LCD window.

The automatic self-test consists of the following tests:

- Board-level tests
- Random access memory (RAM) tests; erasable programmable read-only memory (EPROM) checksum
- On-board data path (sending a known test pattern through an on-board loop)
- Unit-level tests
- Front panel LED verification
- Phase lock loop verification

FRONT PANEL

The front panel monitors operation and controls the unit configuration. Figure 3-1 illustrates the TSU LT 220V front panel. Use the Up and Down arrows on the front panel to access the menus and data fields. At every menu level, pressing **CANCEL** returns the system to the previous menu level. Repeatedly pressing **CANCEL** returns the system to the main menu. Table 3-1 lists the unit features identified by number in Figure 3-1.

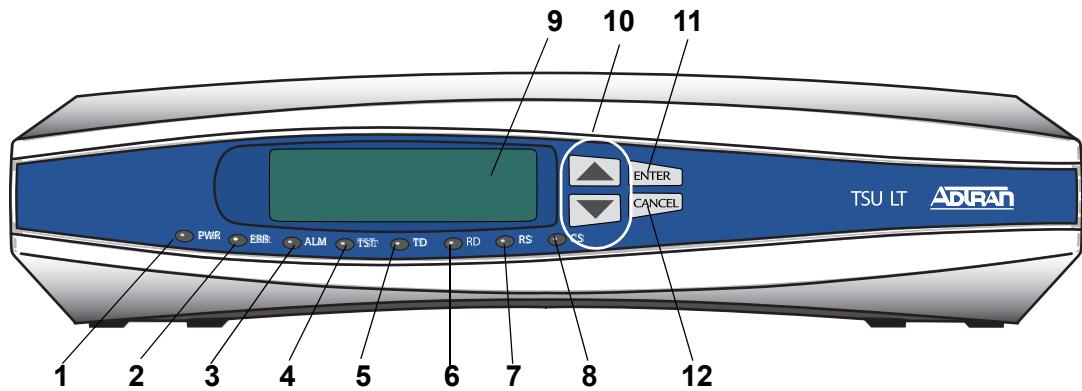


Figure 3-1. TSU LT 220V Front Panel

Table 3-1. Number Identification for TSU LT 220V Front Panel

Item	Displays	Function
1	PWR	LED ON when power is received by the TSU LT 220V.
2	ERR	LED ON when error event occurred in the last second (for example, BPV).
3	ALM	LED ON when an alarm condition exists.
4	TST	LED ON when unit is in test mode.
5	TD	LED ON when DTE data is being transmitted.
6	RD	LED ON when DTE data is being received.
7	RS	LED ON when request to send (RTS) active from DTE.
8	CS	LED ON when TSU LT 220V has clear to send (CTS) active toward DTE.
9	LCD	A 2X16 LCD window that displays menu items used in configuration and displays information useful in monitoring the unit. See also <i>LCD Window</i> on page 24.

Table 3-1. Number Identification for TSU LT 220V Front Panel (Continued)

Item	Displays	Function
Operation Keys		
10	Up/Down Arrows	Keyboard arrows used to travel up/down menu trees. Arrows increase/decrease numeric values and scroll through selections.
11	Enter	Used to choose paths and make selections.
12	Cancel	Used to exit selections or menu tree branches.

LCD WINDOW

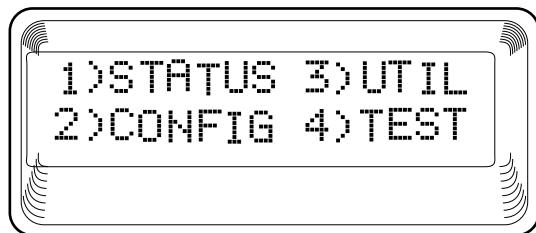
The TSU LT 220V uses a multilevel menu structure containing both menu items and data fields. The opening (main) menus are the access points to all other operations. The TSU LT 220V front panel LCD displays these numbered menus and data fields. Table 3-2 lists features you should look for in the LCD when viewing the menus and data fields.

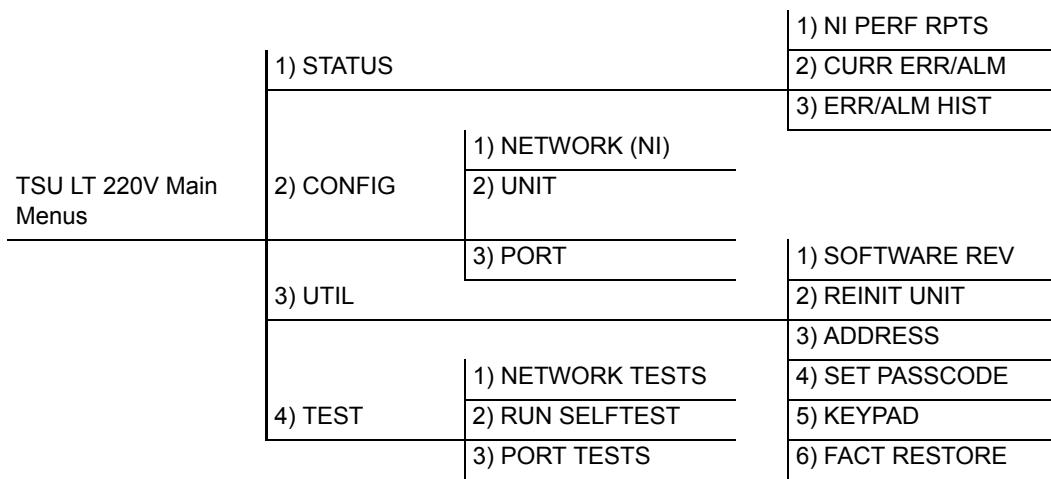
Table 3-2. LCD Features

Feature	Description
Data Fields	A menu item followed by a colon (:) identifies an editable data field.
Display Field	A menu field followed by alarm or error information (read-only).
Arrows	Menus that display small Up or Down arrows in the lower right corner of the window indicate there are more menu items than are viewable on a two-line LCD. The additional menu items are accessed with the front panel Up or Down arrows.

MAIN MENUS

Each main menu has several submenus to identify and access specific parameters. The four main menus include **1)STATUS**, **2)CONFIG**, **3)UTIL**, and **4)TEST**. Figure 3-2 shows the main menus in the front panel's LCD window. Figure 3-3 on page 25 shows the menu tree for main menus and first-level submenus. (Appendix A, *TSU LT 220V Menu Tree*, on page 51 contains the complete TSU LT 220V menu tree.)

**Figure 3-2. TSU LT 220V Main Menu Screen**

**Figure 3-3. TSU LT 220V Main Menus**

Status

Use the **STATUS** menu to view the operational status of the TSU LT 220V. (Also see *Status Menu* on page 31.) This menu includes the following submenus:

- NI PERF RPTS** Use to view and reset the user set of data on the Network Interface Performance Reports. These reports are in compliance with ANSI T1.403 and AT&T document TR54016.
- CURR ERR/ALM** Use to view current errors and alarms as reported by the TSU LT 220V.
- ERR/ALM HIST** Use to view and clear the history of errors and alarms.

Config (Configuration)

Use the **CONFIG** menu to set the TSU LT 220V operational configuration. (Also see *Config Menu* on page 35.) This menu includes the following submenus:

- NETWORK (NI)** Use to set all of the parameters associated with the network interface.
- UNIT** Use to control the TSU LT 220V control-port baud rate and to set up the dial-out function.
- PORT** Use to configure the parameters associated with the DTE (V.35) port.

Util (Utility)

Use the **UTIL** menu to view and to set system parameters. (Also see *Utility Menu* on page 43.) This menu includes the following submenus:

SOFTWARE REV	Use to display the version number of the current software revision level. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.
REINIT UNIT	Use to reinitialize the unit (runs a self-test). This menu does not restore the factory default settings.
ADDRESS	Use to view and change the current unit address used for control-port access. Acceptable addresses are 0002 through 9999.
SET PASSCODE	Use to set a passcode for use with KEYPAD .
KEYPAD	Use to lock the front panel keypad so that no accidental changes are made to the menus. Enter the passcode to unlock the keypad (see <i>Set Passcode</i> on page 44).
FACT RESTORE	Use to restore factory default settings for all unit parameters.

Test

Use the **TEST** menu to initiate different types of unit tests and to view test results which are displayed in the LCD window. (Also see *Test Menu* on page 45.) The menu contains three submenus:

NETWORK TESTS	Use to control the activation of loopbacks and the initiation of data test patterns.
RUN SELF TEST	Use to execute an internal self-test.
PORT TESTS	Use to test the DTE (V.35) port.



Test execution disrupts some normal operations. See the individual test menu descriptions before executing a test.

EXAMPLE MENU OPERATIONS

The following examples show you how to select a main menu item and submenu item, how to set a data field, how to view a data field, and how to exit any menu or display.

Selecting a Main Menu Item

To select a main menu item, perform the following steps:

1. Use the front panel Up and Down arrows to place the cursor on a main menu item; in this example, **2) CONFIG**. See Figure 3-4.
2. Press **ENTER**.

The unit responds by displaying the first two available submenu fields (see Figure 3-5). The cursor is on the first field. If there are more than two menu fields, a down arrow is visible in the lower right corner. Use the front panel Down arrow to access additional selections.

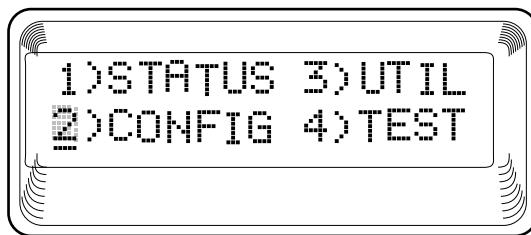
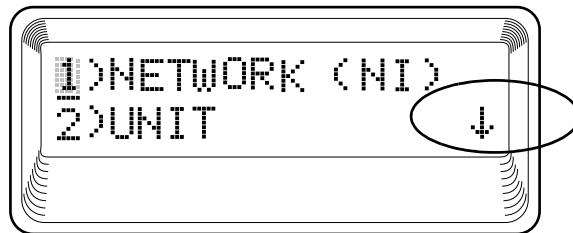


Figure 3-4. Cursor on Menu Item



Arrow indicates that
more submenus are
available.

Figure 3-5. Submenu Fields

3. To exit out of a main menu, press **CANCEL**.

Selecting a Submenu

To select a submenu, perform the following steps:

1. Follow the same steps used to select a main menu.
2. Use the front panel Up and Down arrows to place the cursor on a menu; in this example, **1)NETWORK (NI)**.
3. Press **ENTER**.

The unit responds by displaying the first two available data field items. The cursor is on the number of the first item. When there are more than two data field items for the selected submenu, a down arrow is visible in the lower right corner. Use the front panel Down arrow to access additional selections.

Setting Data Fields

Data fields that are available for editing are preceded by a colon (:). For this example, set the **FORMAT** type.

1. Follow this path: **2) CONFIG > 1)NETWORK (NI) > 1)FORMAT**:
2. Press **ENTER** while the cursor is located on **1)FORMAT**: The cursor moves to the current data field (to the right of the submenu item name).

You can now use the Up and Down arrows to scan the available settings, which display in the data field position one at a time.

3. When the appropriate value is in the data field position, press **ENTER** to set the value.

The unit is set for the value shown in the data field and the cursor moves back to the submenu item position indicating the operation is complete. You can select another submenu field or press **CANCEL** to return to the submenu.



CANCEL is available any time during the operation. If used prior to pressing **Enter** after making a data change, the original data value is restored and the cursor returns to the submenu field.

Viewing Display-Only Data Fields

To view an example of a **DISPLAY ONLY** data field, navigate through the following menus:

1. Select **STATUS** from the main menu.
2. Select submenu **CURR ERR/ALM**.

LOSS OF SIGNAL INACTIVE/ACTIVE is displayed, giving the current state of the alarm.

Exiting Any Menu Field Operation or Display

1. Press **CANCEL** as many times as required to return to a menu level.

ALTERNATE METHOD OF CONTROL FROM TSU LT 220V

T-Watch PRO Management Software Program

T-Watch PRO is the ADTRAN management software program that allows the user to control the TSU LT 220V from a PC. It provides complete control over the configuration of the TSU LT 220V using a graphic interface. The T-Watch PRO program displays the same status and performance data as the front panel LCD. This data is displayed as tables and graphs. In addition, T-Watch PRO has the following capabilities:

- A modem interface permits dialing into a remote TSU LT 220V to configure the unit, view the unit's status, or check its performance.
- The performance data read from the units can be exported to a file which is compatible with common spreadsheet programs.

The **STATUS** menu branch lets you view the operational status of the TSU LT 220V. Figure 4-1 shows the complete **STATUS** menu tree.

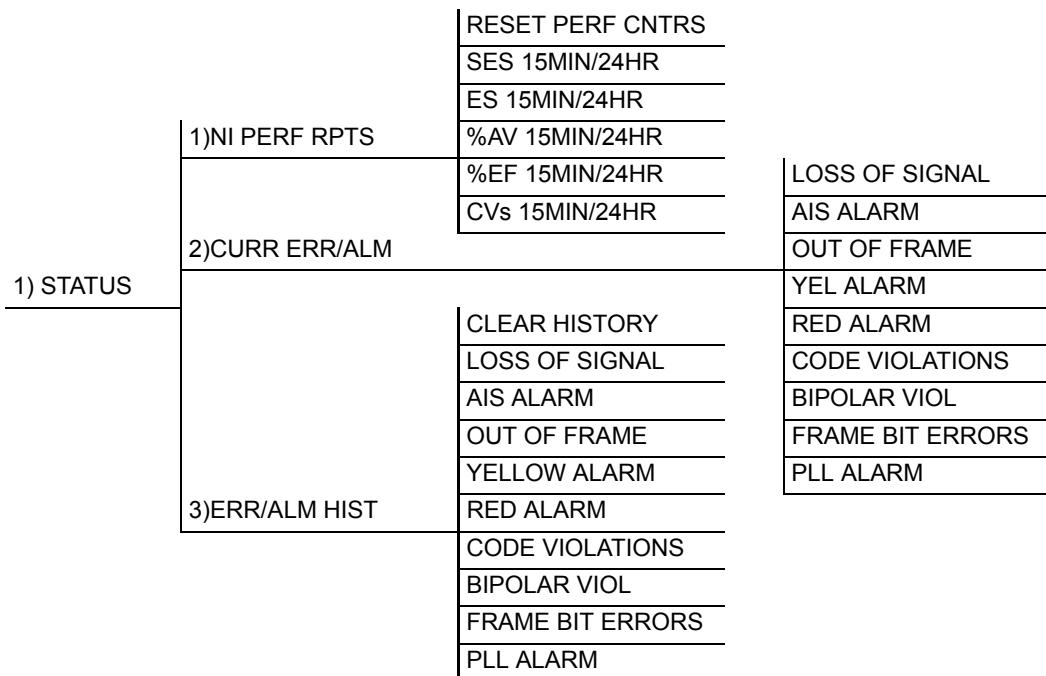
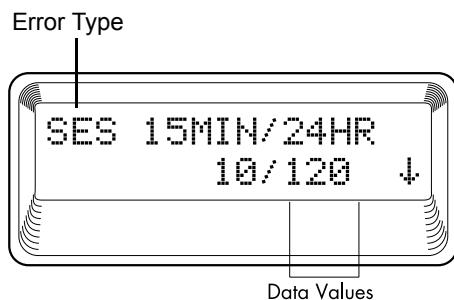


Figure 4-1. Status Menu Tree

NI PERF RPTS MENU

This branch (network interface performance reports) displays the *user* copy of the performance data. The TSU LT 220V also maintains this performance data on the network in compliance with ANSI T1.403 and AT&T document TR54016. The data displayed is data accumulated over the last 15 minutes and over the last 24 hours.

These fields cannot be edited, only viewed or cleared. To clear the counters, move to the **RESET PERF CNTRS** menu and press **ENTER**. To exit the menu, press the front panel **CANCEL** key. Only the user copy of performance data is cleared. Figure 4-2 on page 32 shows the LCD for an **SES** menu. Table 4-1 on page 32 shows the other data types available from the **NI PERF RPTS** menu.

**Figure 4-2. Severely Errored Seconds Screen****Table 4-1. Network Interface Performance Reports (15 Min / 24 Hours)**

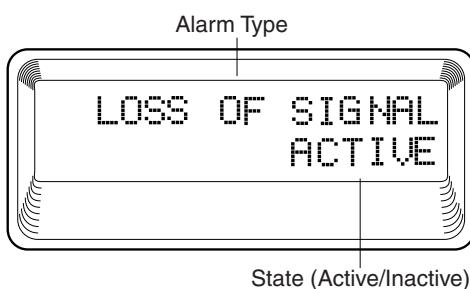
Data Type	Description
SES	Number of severely errored seconds
ES	Number of errored seconds
%AV	Percentage of available seconds
%EF	Percentage of error free seconds
CVs	Number of code violations



Since only the user's copy of performance data is cleared by the TSU LT 220V, the data displayed here might be different from the data being sent to the network as performance report message (PRM) data.

CURR ERR/ALM MENU

Use this branch for viewing currently active or inactive errors and alarms. Use the front panel Up and Down arrows to move through the errors and alarms. Figure 4-3 shows an LOS alarm. Table 4-2 on page 33 provides a complete list of the errors and alarms.

**Figure 4-3. Loss of Signal (Current Errors/Alarms) Screen**

ERR/ALM HIST MENU

Use this branch for viewing a history of errors and alarms. If an alarm has occurred since the last **CLEAR HISTORY** selection, the menu condition is active; otherwise it is inactive (see Figure 4-4). Table 4-2 provides a complete list of the errors and alarms.

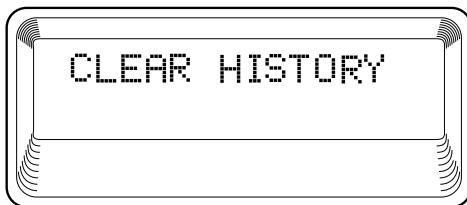


Figure 4-4. Clear History Screen

Table 4-2. Alarms and Errors (Current and Historical)

Errors and Alarms	Meaning
Loss of Signal	No pulses received at NI
AIS Alarm	Unframed All-Ones received at NI
Out of Frame	No framing pattern sync at NI
Yellow Alarm	Receiving yellow alarm pattern from NI
Red Alarm	Loss of signal/out of frame (LOS/OOF) causing red alarm at NI
Code Violations	Cyclic redundancy check (CRC) errors in ESF, or bipolar violations (BPVs) in Superframe Format (SF) were received at NI
Bipolar Violations	BPVs (the presence of two consecutive bits of the same polarity) in SF or ESF
Frame Bit Errors	Frame Bits received incorrectly at NI
PLL Alarm	Unable to sync up to selected clock

Use the **CONFIG** menus to set the TSU LT 220V operational configuration, including all of the network interface parameters, the allocation of the DS0s, and the port parameters. This menu includes three branches: **NETWORK (NI)**, **UNIT**, and **PORT**. Figure 5-1 shows the complete menu tree.

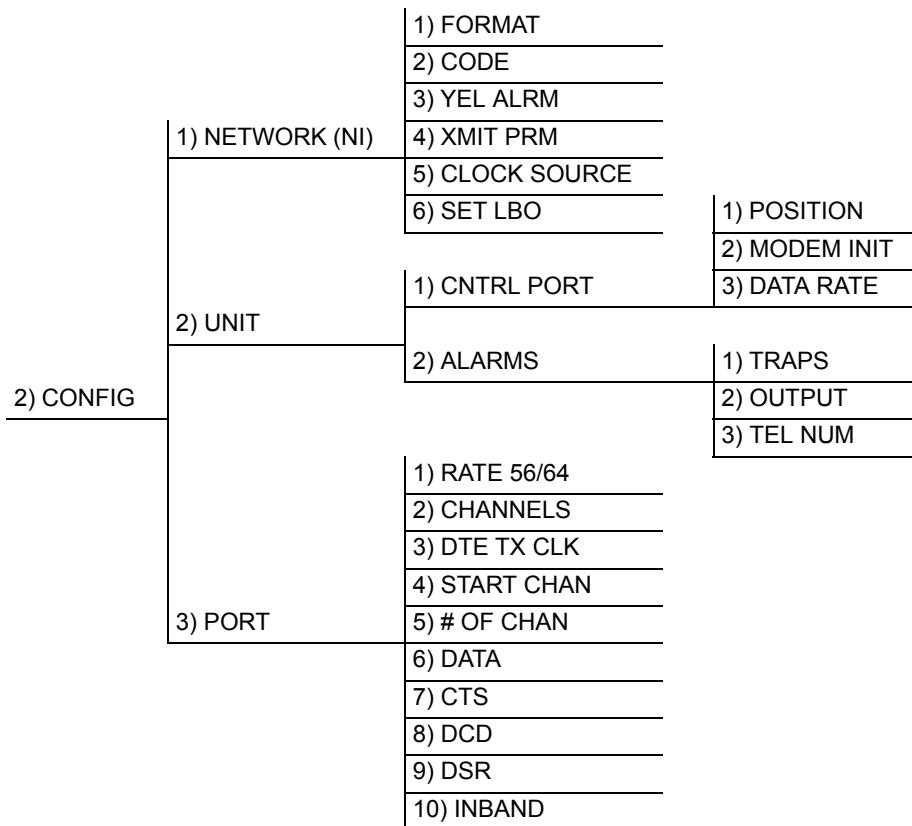


Figure 5-1. Configuration Menu Tree

NETWORK (NI) MENU

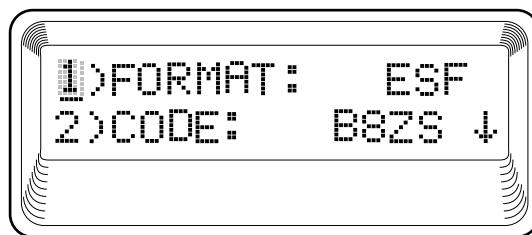
Use this menu to access the configuration of parameters associated with the network interface in the TSU LT 220V. This branch includes six submenus (see Table 5-1 on page 36). Figure 5-2 on page 36 shows one submenu.

Table 5-1. Network Interface Submenus

Submenu	Description
FORMAT	Sets the frame format for the NI. Choices: D4, ESF, AUTO ^a
CODE	Sets the line code for the NI. Choices: AMI, B8ZS
YEL ALRM	Enables and disables the transmitting of yellow alarms. Choices: ENA (enable), DISA (disable)
XMIT ALRM	Enables and disables the transmitting of performance report message (PRM) data on the facility data link (FDL). The PRM data continues to be collected even if XMIT PRM is disabled (possible only with ESF Format). Choices: ENA (enable), DISA (disable)
CLOCK SOURCE ^b	Selects the clock source for transmission toward the network from the NI. Choices: NETWORK, DTE, INTERNAL
SET LBO	Selects the line build-out (amount of attenuation, in dB) for the network interface. Choices: 0, 7.5, 15, 22.5

a D4 is equivalent to Superframe Format (SF).

b For more information on clock sources and timing, see *Clock Sources and Timing* on page 36.

**Figure 5-2. Network Submenu**

Clock Sources and Timing

The TSU LT 220V operates from various clock sources, permitting it to perform properly in many different applications. Use the **CONFIG > NETWORK (NI) > 5)CLOCK SOURCE:** menu to set the network interface clocking options (network, DTE, or internal timing). See the descriptions for *Network Timing* on page 37, *DTE Timing* on page 37, and *Internal Timing* on page 38.



The clocking option selected always designates the clock source for transmission. Clocking necessary for receiving data is always recovered from incoming data.

Network Timing

The network is the source of timing. The received data clocking is looped back to the network, where it is used to determine the transmission timing. This option is also referred to as looped timed as the transmission clock is derived from the received clock. See Figure 5-3.

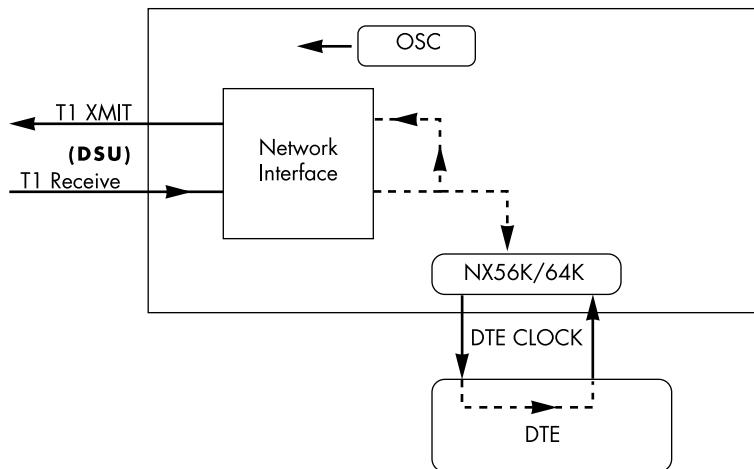


Figure 5-3. Network Timed Clock Source

DTE Timing

The DTE is the source of timing. The TSU LT 220V uses the incoming DTE clock to determine the transmission timing. This is typically used in applications such as limited distance line drivers, where it is necessary to have the DTE as the primary clock source (see Figure 5-4).

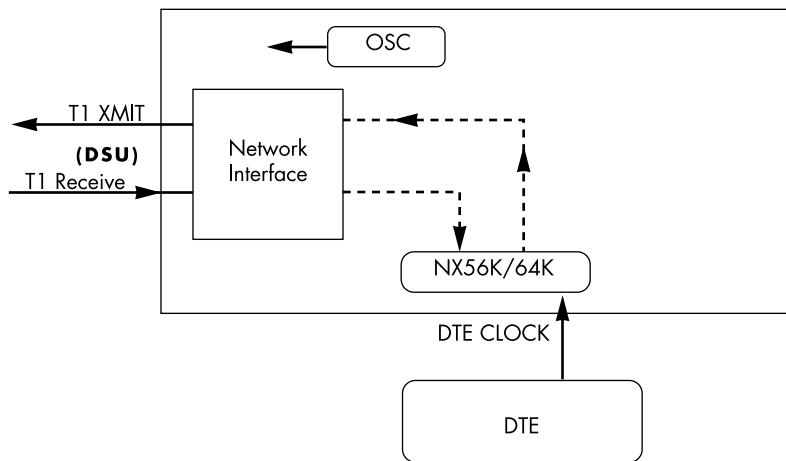


Figure 5-4. DTE Clock Source

Internal Timing

The TSU LT 220V is the source of timing. The TSU LT 220V is configured to use its own internal oscillator as the source of timing. Applications include private line driver circuits where one end is set to network and the other to internal. See Figure 5-5.

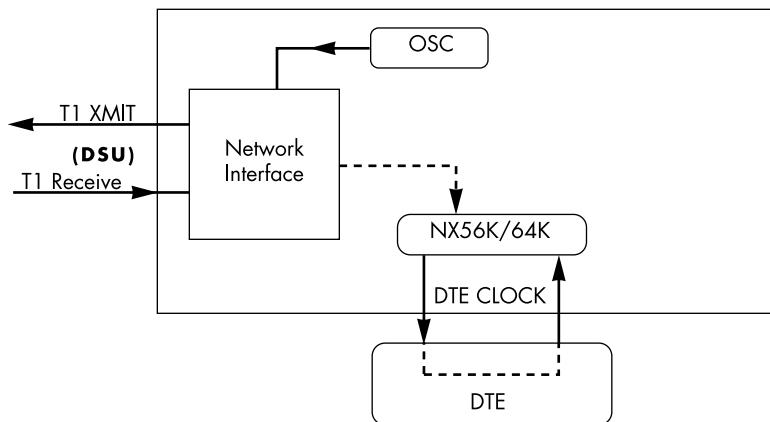


Figure 5-5. Internal Clock Source

UNIT MENU

Use the **UNIT** submenus to change control port and alarm options. Figure 5-6 shows a sample LCD window.

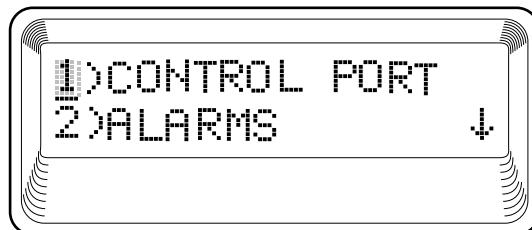


Figure 5-6. Configuration Submenu

Cntrl Port Submenu

Use to set up the unit as the master or slave on a chain of units, and to initialize a modem and the control port data rate.

POSITION [of TSU LT 220V] This option determines whether the TSU LT 220V is at the head of a chain of units (directly connected to the modem or PC). The head of the chain is referred to as the master unit. Units down the chain are referred to as slaves or a slave unit.

Setting the position is only necessary when you are using a modem, in which case the head unit should be **MASTER**. For all other cases, select **SLAVE**. (The master is in charge of control of the modem.)

Choices: MASTER, SLAVE

MODEM INIT Use this option to initialize a modem, but only when the TSU LT 220V is serving as the **MASTER** unit. The modem should be physically connected to the TSU LT 220V with the power turned on prior to initialization. At this point, an industry-standard AT command string is used to initialize the modem. The string is also used following future power-up sequences.

Choices: ENA (enable), DISA (disable)

DATA RATE Selects the data rate for the control port. The data rate should be consistent with all units on a chain and with the modem and/or PC/Proxy Agent serial port.

Choices: 1200, 2400, 9600

Alarms Submenu

Use these submenus to initialize the method by which the control port handles alarm conditions.

TRAPS Determines whether alarm conditions should automatically trigger an alarm message (trap) to the controlling PC/Proxy Agent. The setting is for this unit, or for slaves if this unit is a master. For applications where the **AUTO INBAND** selection is not acceptable, **TRAPS** should only be enabled with the Inband selection set to **ON** or **OFF**.

Choices: ENA (enable), DISA (disable)

OUTPUT Selects whether the alarm traps (if enabled) are sent directly, or whether the telephone number stored in the TSU LT 220V should be dialed first (industry-standard AT dial command sent to modem).

Choices: DIRECT, DIAL

TEL NUM Sets the telephone number to be dialed to send alarm traps. The string can be up to 20 characters in length and is terminated with a semicolon (;) as the last character. A colon (:) character is used to represent a pause in the dial string.

For example, for number 9:5551212; dial 9, pause momentarily and then dial 5551212. This pause could be necessary to access an outside line, such as a PBX. When editing a specific character, the arrows are used to scroll from 0 to 9, then colon (:) and semicolon (;). The new telephone number is entered into the TSU LT 220V only after typing the semicolon and pressing **ENTER**.

Choices: 20 digits (0-9, :, and ;)



*The **ALARM > TEL NUM** menu only accepts the typed digits after pressing **ENTER***

PORt MENU

Use this menu to select and configure the parameters associated with the V.35 port.

RATE 56/64 Sets the base rate of the interface. The actual data rate depends on the number of DS0s assigned to the Nx port. The DTE data rate versus the number of DS0s appears in Appendix B, *DTE Data Rate Chart*, on page 53.

Choices: 56K, 64K

CHANNELS Sets the unit to use **ALTERNATE** or **CONTIGUOUS** channels in the T1 data stream. If more than 12 channels are used, then **CONTIGUOUS** must be used. Otherwise, **ALTERNATE** channels may be used to meet pulse density requirements (this is only necessary for Nx 64 without B8ZS). If other than a private network, the carrier must be notified of this choice.

Choices: ALT (alternate), CONT (contiguous)

DTE TX CLK Controls the clock used by the TSU LT 220V to accept the transmit (TX) data from the DTE. Most applications will allow for this to be set to **INTERNAL**. If the interface cable is long (causing a phase shift in the data) the clock can be selected as **INT-INV** (Internal/Inverted - the factory default setting). This switches the phase of the clock, which should compensate for a long cable.

The **AUTO** setting allows the TSU LT 220V to automatically detect the delay from the DTE device to the TSU LT 220V and set the proper phase of the clock. This feature automatically selects between the **INTERNAL** and **INT-INV** settings. If the DTE provides a clock with TX data, the clock selection is set to **EXTERNAL**. The TSU LT 220V depends on an externally supplied clock to accept the TX data.

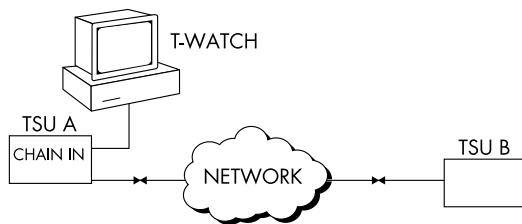
Choices: INT-INV, INTERNAL, EXTERNAL, AUTO

START CHAN	Sets the starting channel for the T1 stream. This setting must be consistent with the carrier if using a public network. Choices: 01 through 24
# OF CHAN	Sets the number of DS0s (channels) to be used. The corresponding DTE rate will be this number times 56K or 64K, depending on the setting of 1)RATE 56/64 . Choices: 01 through 24
DATA	Controls the inversion of DTE data. This inversion can be useful when operating with an HDLC protocol. Often used as a means to ensure ones (1s) density. TSU LT 220Vs on both ends must have identical option settings. Choices: NORMAL, INVERT
CTS	Clear To Send - Signal sent from the receiving station to the transmitting station that indicates that the receiving station is ready to accept data. Choices: NORMAL (see Table 5-2 on page 42), FORCE ON
DCD	Data Carrier Detect - Indicates to the DTE that a valid signal is being received at the Network Interface. Choices: NORMAL (see Table 5-2 on page 42), FORCE ON
DSR	Data Set Ready - Indicates to the DTE that the DCE is turned ON and ready for operations. Choices: NORMAL (see Table 5-2 on page 42), FORCE ON.
INBAND	Inband Configuration Channel - Use to enable/disable an 8-kbps remote configuration channel (see Figure 5-7 on page 42). When this option is set to ON , the first DS0 occupied operates in 56K mode and the DTE clock rate is reduced by 8 kbps. The TSU LT 220V uses this 8-kbps channel to send and receive configuration data across a T1 span. As shown in Figure 5-7, this feature allows the PC connected to the Chain In port on TSU LT 220V A to monitor and configure both TSU LT 220V A and B. This feature is useful when FDL connectivity is not available across the T1 span. The 8-kbps channel is only taken out of the first DS0. If two 64K DS0s are mapped, the DTE rate would be 120 kbps instead of 128 kbps. This menu option can also be set to AUTO , which activates the Inband Channel only when commands are sent from T-Watch PRO to the remote unit (TSU LT 220V B in Figure 5-7). If no T-Watch PRO activity is detected for 10 minutes, the Inband Channel is deactivated.

Table 5-2. Normal Mode Operation

NORMAL MODE OPERATION							
Conditions which cause the Port Control Signals to be deactivated							
SIGNAL	RTS	V.54 LOOP BK	511 TST ON	SELF-TEST ACTIVE	NETWK TEST ACTIVE	NO DS0 MAPPED	NETWORK ALARM
CTS	Follows	OFF	OFF	OFF	OFF	OFF	OFF
DCD	—	—	—	OFF	—	OFF	OFF
DSR	—	OFF	OFF	OFF	OFF	OFF	—

Where “—” = don't care

**Figure 5-7. Inband Remote Configuration**

Use the **UTILITY** branch to view the unit's software revision, to reinitialize the unit, to set system parameters, and to restore factory default settings (see Figure 6-1).

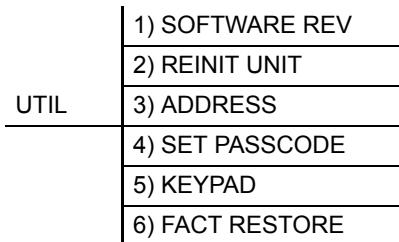


Figure 6-1. Utility Menu Tree

SOFTWARE REV

Displays the current software revision level. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

REINIT UNIT

Reinitializes the unit. Do not use this submenu to restore the factory default settings for all parameters; instead, use the factory restore submenu (number 6).

ADDRESS

Displays and changes the unit address setting. To view the address, navigate to this menu. To change the address, highlight **ADDRESS** and press **ENTER**. Then use the Up and Down arrow keys to change the digits. After changing a digit, press **ENTER** to move to the next digit. To skip a digit, press **ENTER** while the cursor is blinking on that digit. Unit identification numbers must be between 0002 and 9999. See Figure 6-2 on page 44.

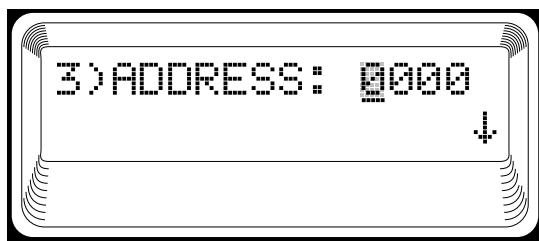


Figure 6-2. Address Screen

SET PASSCODE

The TSU LT 220V uses passcodes for front panel security and T-Watch PRO access. Use **SET PASSCODE** to add, change, or delete a passcode. Acceptable codes are 0000 through 9999. Four question marks (????) indicate the keypad is locked.

To alter the passcode, highlight **PASSCODE** and press **ENTER**. Then use the Up and Down arrow keys to change the digits. After changing a digit, press **ENTER** to move to the next digit. To skip a digit, press **ENTER** while the cursor is blinking on that digit.

KEYPAD

Allows the user to lock or unlock the front panel keypad. This feature keeps the unit configuration from being changed by unauthorized personnel. When the keypad is **LOCKED**, option settings can be viewed but not changed (unless the passcode is entered). When the keypad is **UNLOCKED**, the menus can be changed at will. If an incorrect passcode is entered, the unit remains locked.

FACT RESTORE

Use the **FACTORY RESTORE** submenu to restore the factory default setting for all unit parameters.

The **TEST** submenus initiate different types of unit tests and let you view test results in the LCD window (see Figure 7-1). This menu contains three branches: **NETWORK TEST**, **RUN SELFTEST**, and **PORT TESTS**.

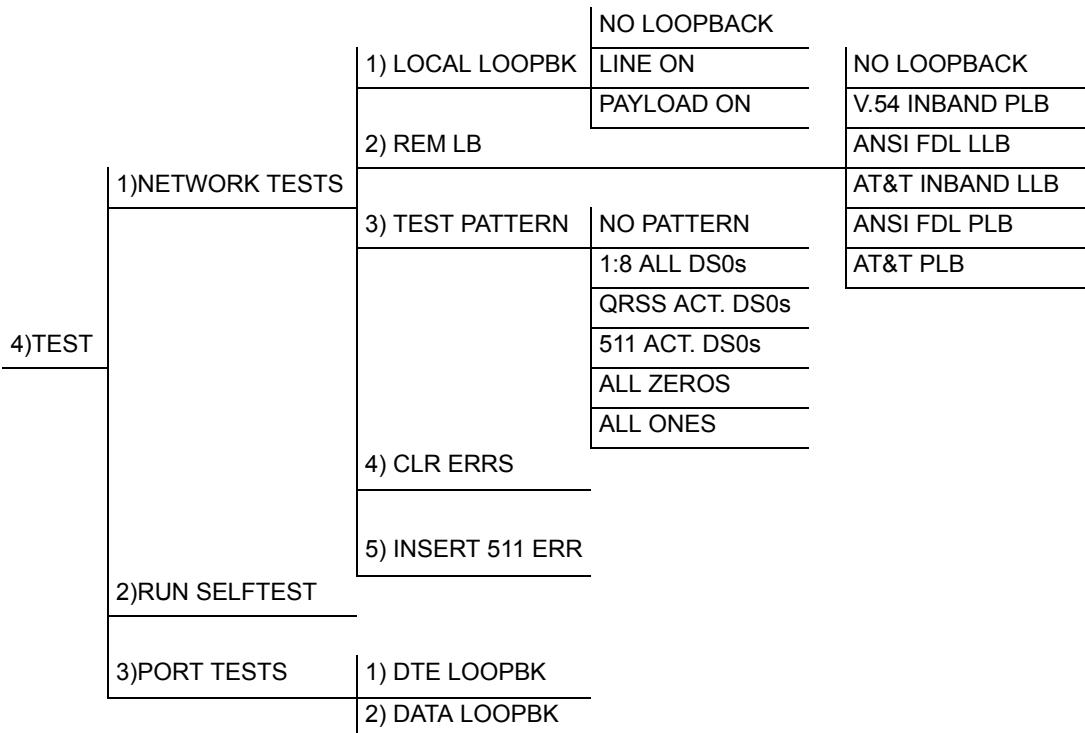
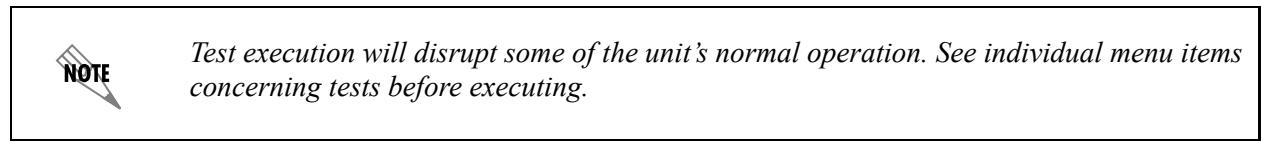


Figure 7-1. Test Menu Tree

NETWORK TESTS

Network tests control the activation of loopbacks and the initiation of data test patterns. They run on the network interface (NI). Options include **1) LOCAL LOOPBK**, **2) REM LB**, **3) TEST PATTERN**, **4) CLR ERRS**, and **5) INSERT 511 ERR**.

Local Loopback

The three choices available for setting the local loopback include **No LOOPBACK**, **LINE ON**, and **PAYOUT ON**. Figure 7-2 shows an illustration of how the tests work.

- No Loopback** Deactivates the loopback.
- Line On** Activates the line loopback, which loops all of the received data back toward the network. The transmitted data is the identical line code that was received, including any bipolar violations or framing errors.
- Payload On** Activates the payload loopback, which is similar to line loopback except that the framing is extracted from the received data and then regenerated for the transmitted data.

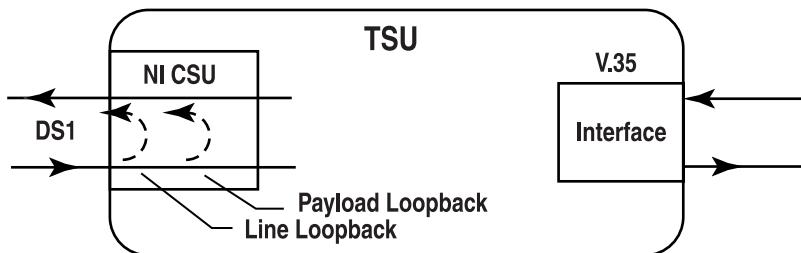


Figure 7-2. Network Loopback Tests

Remote Loopback

Activates loopback tests at the far end.

- No Loopback** Deactivates the loopback.
- V.54 Inband PLB** Indicates inband transmission of V.54 loop-up pattern in channels occupied by DTE data only. This choice should be used for public fractional network.
- ANSI FDL LLB** Per ANSI T1.403, initiates the transmission of a Facility Data Link (FDL) line loop-up code toward the far end using the following 2-byte bit patterns: 00001110 11111111.
- AT&T Inband LLB** Per AT&T 62411, activates the line loopback using inband code.
- ANSI FDL PLB** Per ANSI T1.403, activates the payload loopback (PLB) on the FDL using the following 2-byte bit patterns: 00010100 11111111.
- AT&T FDL PLB** Per AT&T TR54016, initiates the transmission of the PLB on the FDL using a request message.



Only V.54 loopbacks can be used with fractional T1 since the full T1 stream including the FDL is not transported to the far end (unless it is a private network).

Facility Data Link (FDL) specifically relates to ESF.

Test Pattern

Selects the test pattern and initiates the transmission of the pattern. There are five patterns available (see below). End testing by selecting **NO PATTERN**.

1:8 ALL DS0s	Generates a 1 in 8 pattern in all DS0s.
QRSS Active DS0s	Generates a 4 QRSS test pattern and inserts the pattern into currently active channels.
511 Active DS0s	Generates a 511 test pattern and inserts the pattern into currently active channels.
All Zeros	Generates an all zero's pattern in every channel.
All Ones	Generates an all one's pattern in every channel.

CLR Errors

CLR ERRORS has two functions. First, it clears out the 511 error total when you press **ENTER**. Second, it displays a total of the 511 errors; that is, if 511 errors are being received, the display updates accordingly. This function is useful in testing end-to-end integrity of the network. To do this, first, loop up the far end TSU LT, and send a 511 pattern from the local TSU LT. Then, view the **CLR ERRORS** screen to determine whether the link is functioning properly by verifying that no errors are being counted.

Insert 511 Errors

When running a 511 pattern test, press the **ENTER** key to insert an error into the 511 pattern.

RUN SELF-TEST

Use this menu to execute an internal self-test. This is the same self-test that is automatically performed at power-up. After displaying **INITIALIZING**, the LCD shows the results (including failures) of the self-test (see Figure 7-3).

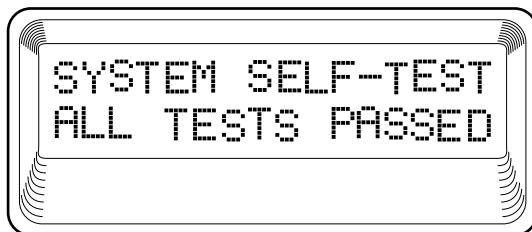


Figure 7-3. Self Test Results Screen

The self-test includes the following board-level tests, in this order:

1. RAM tests; EPROM checksum
2. On-board data path; sending a known test pattern through an on-board loop
3. Front panel LED verification
4. Phase lock loop verification. If a failure is detected, note the failure number and contact ADTRAN Technical Support.



Executing self-test disrupts normal data flow and prevents remote communication until the self-test is completed (approximately five seconds).

POR TESTS

These two tests (**DTE LOOPBK** and **DATA LOOPBK**) control the activation of a DTE loopback and a data loopback (see Figure 7-4). The **DTE Loopbk** loops data received at the V.35 interface back towards the DTE. In the **DATA LOOPBK** test, the data is looped back just before going out the V.35 interface.

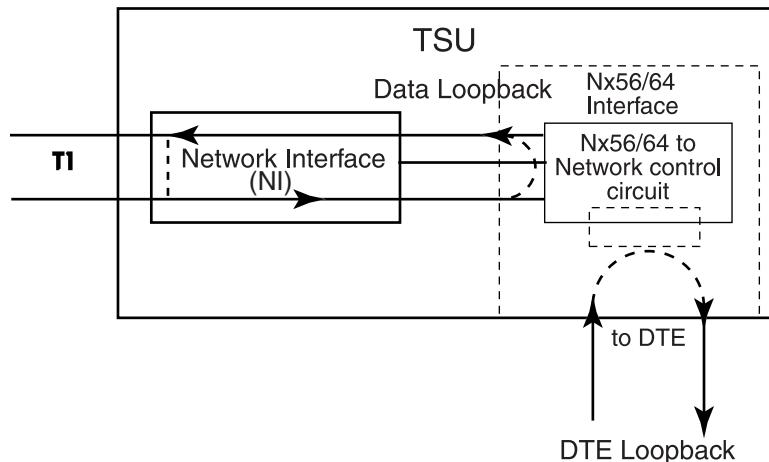


Figure 7-4. Port Loopback Tests

ADTRAN recommends running tests on the circuit before using the TSU LT 220V to pass data. Testing consists of sending a test pattern from end-to-end and checking for errors in the pattern. Two types of tests are used to accomplish this:

1. Loop-up the far end and then send a test pattern.
2. Send a test pattern from both ends and check at both ends.

Far End Looped Back Test

TSU LT 220Vs should respond to a loop-up code sent over the T1 circuit. The remote unit will “loop” the network interface, providing a path for data from the local unit over the circuit and back again. Sending a known test pattern over this loop and checking for errors verifies circuit connectivity. The following example loops the remote unit and sends a 511 pattern through the data path. Use the 511 test pattern with any T1 configuration (regardless of the channel configuration) because 511 is always sent in the occupied channels. Complete the steps outlined below to loop-up the remote TSU LT 220V and send a test pattern.

Running the Test

1. Use the front panel Up and Down arrows to place the cursor on **4) TEST**; press **ENTER** to select.
Result: The first two **TEST** submenu items display.
2. Using the up and down arrows, place the cursor on **NETWORK TESTS**; press **ENTER**.
Result: Beginning display of the submenu items. Each menu item can be selected with the up and down arrows.
3. Use the front panel up and down arrow keys to place the cursor on **REM LB**; press **ENTER**.
4. Move to **V.54 INBAND PLB** and press **ENTER**.
5. Now, use the front panel down arrow key to select **3) TEST PATTERN**.
6. Press **ENTER** again to activate the **TEST PATTERN** submenu; select **511 ACT DS0s**.
7. Press **ENTER** to activate the selection.

Result: The TSU LT 220V always checks for 511 errors. The results of this check are shown under submenu item 4.

Ending the Test

When you have finished viewing the results, complete the following steps to return the TSU LT 220V to normal operation:

1. Press **CANCEL** to return to submenu item **TEST PATTERN**.
2. Select **NO PATTERN** to terminate the test and the 511 pattern generation.

Result: The far end remains in loopback until the network **REMOTE LOOPBK** is set to **No Loopback** under submenu item **REMOTE LOOPBK**.

Appendix A

TSU LT 220V Menu Tree

Figures A-1 and A-2 show the complete menu tree for the TSU LT 220V.

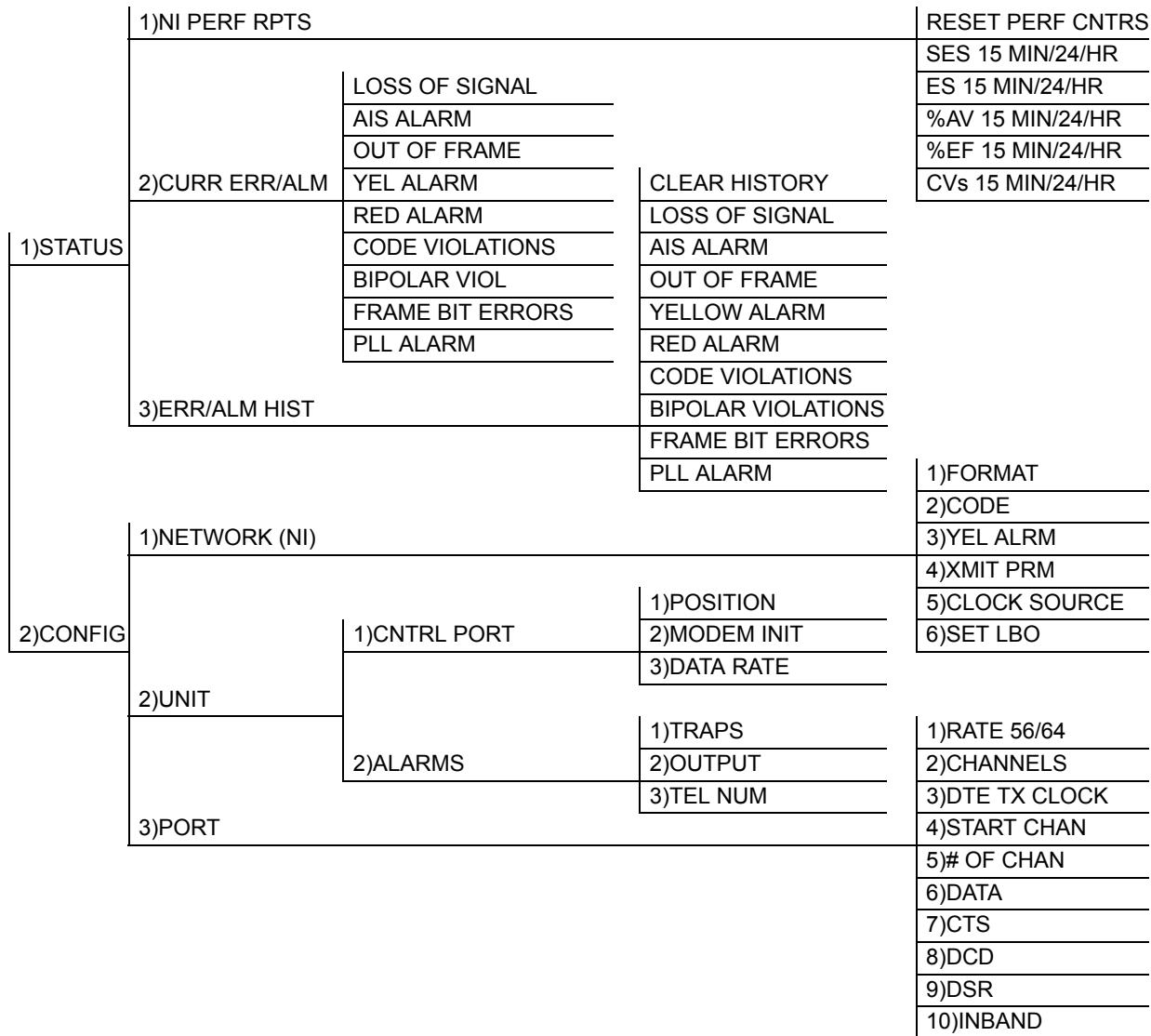
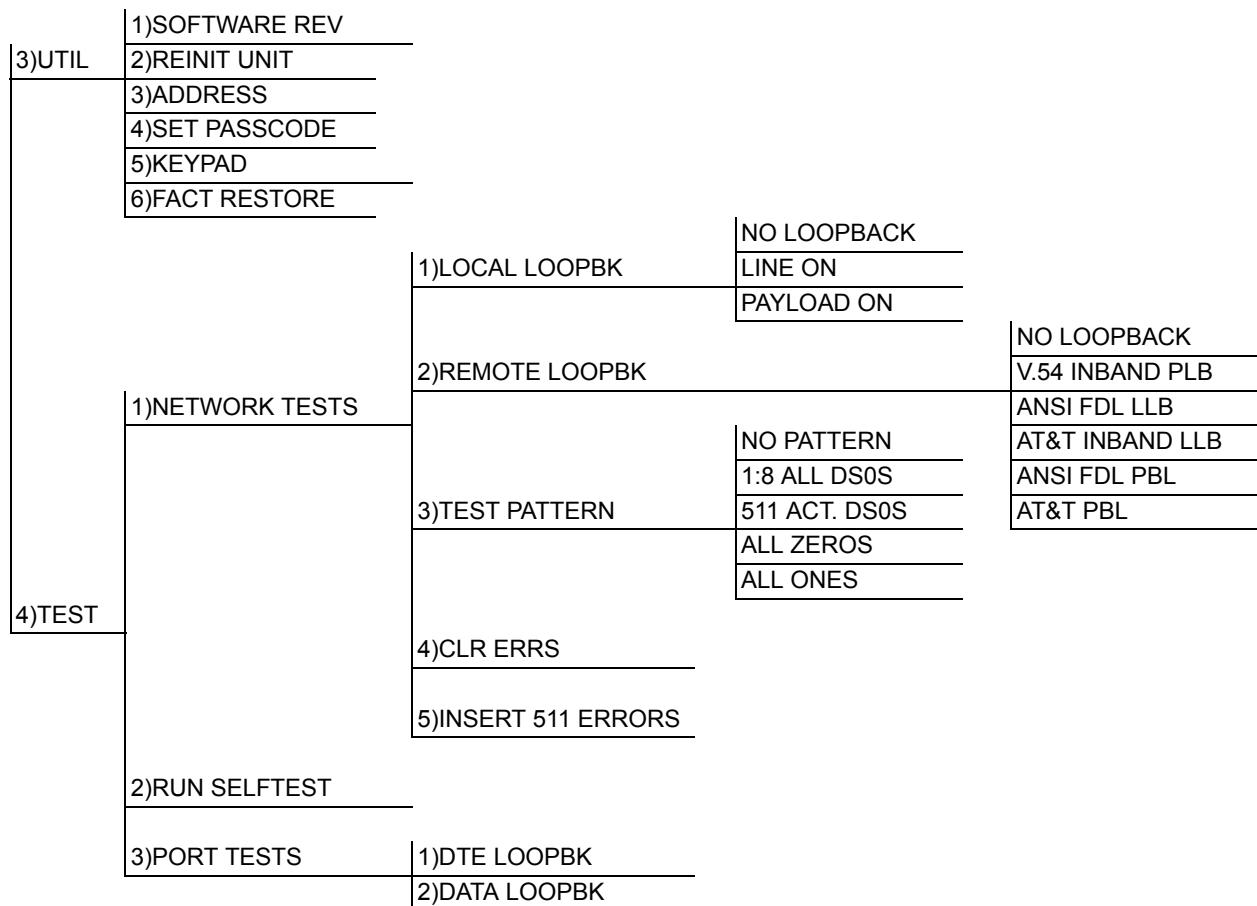


Figure A-1. TSU LT 220V Menu Tree (Status and Config)

**Figure A-2. TSU LT 220V Menu Tree (Util and Test)**

DTE Data Rate Chart

The DTE data rate chart is shown in Table B-1.

Table B-1. DTE Data Rate Chart

# OF DS0s (N)	DTE RATE=56K	DTE RATE=64K
N=1	56K	64K
N=2	112K	128K
N=3	168K	192K
N=4	224K	256K
N=5	280K	320K
N=6	336K	384K
N=7	392K	448K
N=8	448K	512K
N=9	504K	576K
N=10	560K	640K
N=11	616K	704K
N=12	672K	768K
N=13	728K	832K
N=14	784K	896K
N=15	840K	960K
N=16	896K	1024K
N=17	952K	1088K
N=18	1008K	1152K
N=19	1064K	1216K
N=20	1120K	1280K
N=21	1176K	1344K
N=22	1232K	1408K
N=23	1288K	1472K
N=24	1344K	1536K

Appendix C Pinouts

NETWORK (USOC RJ-48C)

The TSU LT 220V rear panel has an eight-position modular jack labeled **NETWORK**. This connector is used for connecting to the T1 network. See Table C-1 for the network connector pin assignments.

Table C-1. Network Pin Assignments

Pin	Name	Description
1	R1 RXDATA	Receive data from the network - Ring
2	T1 RXDATA	Receive data from the network - Tip
3	UNUSED	—
4	R TXDATA	Send data towards the network - Ring
5	T TXDATA	Send data towards the network - Tip
6, 7, 8	UNUSED	—

CONTROL CHAIN IN (RJ-48)

Use the Chain In connector as an EIA-232 port for connection to a computer or modem. See Table C-2 for the pin assignment for this connector.

Table C-2. Chain In Pin Assignments

Pin	Name	Description
1	GND	Ground connected to unit chassis.
2	UNUSED	—
3	RXDATA	Data received by the TSU.
4	UNUSED	—
5	TXDATA	Data transmitted by the TSU.
6	UNUSED	—
7	RI	Ring indicate from modem.
8	UNUSED	—

CONTROL CHAIN OUT (RJ-48)

Use the Chain Out port to connect to another TSU LT 220V Chain In connector. Table C-3 shows the pinout for this connector.

Table C-3. Chain Out Pin Assignments

Pin	Name	Description
1	GND	Ground-connected to unit chassis. Connect to GND of next unit (pin 1).
2	UNUSED	—
3	TXDATA	Data transmitted to chained units by the TSU. Connect to RX DATA of the next unit (Chain In pin 3).
4	UNUSED	—
5	RXDATA	Data received from chained units by the TSU. Connect to TX DATA of the next unit (Chain In pin 3).
6, 7, 8	UNUSED	—

NX56K/64K DTE (V.35)

The TSU LT 220V rear panel (P/N 1202060L2) has a V.35 interface for connecting DTE equipment. Table C-4 shows the pinout for this connector.

Table C-4. V.35 Pin Assignments

Pin	CCITT	Description
A	101	Protective ground (PG)
B	102	Signal ground (SG)
C	105	Request to send (RTS) from DTE
D	106	Clear to send (CTS) to DTE
E	107	Data set ready (DSR) to DTE
F	109	Received line signal detector (DCD) to DTE
H	—	Data terminal ready (DTR) from DTE
J	—	Ring indicator (RI)
L	—	Local loopback (LL)
N	—	Remote loopback (RL)
R	104	Received data (RD-A) to DTE
T	104	Received data (RD-B) to DTE
V	115	RX clock (RC-A) to DTE
X	115	RX clock (RC-B) to DTE
P	103	Transmitted data (TD-A) from DTE
S	103	Transmitted data (TD-B) from DTE
Y	114	TX clock (TC-A)
AA	114	TX clock (TC-B)
U	113	External TX clock (ETC-A) from DTE
W	113	External TX clock (ETC-B) from DTE
NN&K	—	Test mode (TM) to DTE

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